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The examination of pre-service teachers' epistemological beliefs in terms of Hofer's and Hammer & Elby's view

Aylin Cam[a]*, Yusuf Sulun[a], Mustafa Sami Topcu[b], Gokhan Guven[a]

[a]*Mugla Sitki Kocman University, Faculty of Education, Department of Elementary Education, Mugla 48000,TURKEY*
[b]*Yildiz Teknik University, Faculty of Education, Elementary Education, Istanbul 34349, TURKEY*

Abstract

The purpose of the study is to investigate elementary preservice teachers' epistemological beliefs in terms of Hofer (2001) and Hammer & Elby (2002) views. Hofer defines epistemological beliefs as beliefs about knowledge and knowing, while Hammer & Elby (2002) proposes that epistemological beliefs include nature of knowing and learning. In this study, quantitative and qualitative research methods were conducted. The sample of this study consisted of 152 elementary preservice teachers. Preservice teachers' epistemological beliefs were determined by using "Epistemic Belief Inventory" (EBAPS) developed by Hammer & Elby (2002) and "context specific epistemological beliefs questionnaire" (CSEPQ) was developed by Hofer (2001). According to the result of the study, some dimensions of CSEPQ are related to the EBAPS.

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Keywords: Pre-service teachers; epistemological beliefs; Hofer's view; Hammer and Elby view; elementary

1. Introduction

The research related to epistemological beliefs was increased for the past decade (Chen & Pajares, 2010). The reasons of the increase in epistemological beliefs studies are that this construct is interacting with cognitive and metacognitive operations (Chai, Khine & Teo, 2006). Thus, studying students' epistemological beliefs is important in order to make them higher achievers. Accordingly, studying pre-service teachers' epistemological beliefs is also

* Aylin Cam. Tel.: +90252-2113118; fax: +90252-2111762
E-mail address: aylincam@mu.edu.tr

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important because their beliefs about knowledge and knowing affect their teaching method implementation in the real class. Therefore, pre-service teachers' implementation of teaching method is one of the factors that affect their future students' achievement. There are several models for explaining the epistemological beliefs.

Perry (1970) was the pioneer for studying epistemological beliefs and then Belenky, Clichy, Goldberger and Tarule (1986) worked the women's way of knowledge, Baxter-Magolda (1992) studied the epistemological reflection, King and Kitchener (1994) studied the reflective justice, after that Kuhn, Cheney and Weinstock (2000) studied the epistemological understanding of the model. All of these researchers assumed that epistemological beliefs were unidimensional and epistemological beliefs developed longitudinally from simple to complex thinking process. Then, Schommer (1990) proposed that epistemological beliefs were consisted of more than one independent dimension. For example, a student could think that knowledge is acquired gradually, but at the same time he or she could think that knowledge is organized as isolated bits and pieces. Thus, she defined epistemological beliefs as personal and implicit beliefs' systems or students' assumptions about nature of knowledge and learning (Schommer, 1990). These dimensions were as follow: certainty of knowledge, simple knowledge, quick learning, source of learning, and innate ability. She explains these dimensions as follow: *Source* dimension includes the "beliefs about knowledge residing in external authorities", *Certainty* dimension includes the "beliefs in a right answer", *Development* dimension includes the "beliefs about science as an evolving and changing subject", *Justification* dimension includes the "the roles of experiments and how individuals justify knowledge".

Hofer and Pintrich (1997) also proposed that epistemological beliefs are consisted of more than one dimension and at the same time they focused on the domain specificity of the epistemological beliefs. They defined epistemological beliefs as beliefs about knowledge and knowing. They proposed the following dimensions: *certainty of knowledge, simplicity of knowledge, source of knowing* and *justification for knowing*. On the contrary to epistemological beliefs dimension view, Hammer and Elby (2002) proposed that people have many epistemological resources and they stated that when they need something, the specific resource was activated. They suggested some resources such as *knowledge as transmitted stuff* and *knowledge as fabricated stuff*. People could active different resources in different situations. They also proposed the importance of domain specificity of the beliefs about knowledge. For example, people could have different beliefs related to source of knowledge depending on the situation. According to the above information related to the development of epistemological beliefs, there is no consensus among the development of epistemological beliefs (Sandoval, 2014). Thus, the purpose of the present study is to understand the relation between two domain specific frameworks (Hofer & Pintrich (1997) and Hammer & Elby (2002)). The research question of this study is as follow: Was there a significant relation of preservice teachers' epistemological beliefs in terms of Hofer (2001) and Hammer & Elby (2002) views?

2. Method

2.1. Sample

The sample of this study consisted of third grade pre-service science and elementary teachers. The total numbers of pre-service teachers were 154 (116 female, 39 male). The mean age of them was 21. All of the pre-service teachers took General Chemistry, General Biology, General Physics courses and also they took science teaching methods courses. The study was conducted one of the rural universities in Turkey (the population of this city about 80,000). Generally, students were instructed with constructivist approaches in their classroom. When they complete the program, pre-service science teachers are going to be certified to teach science to 5^{th} through 8^{th} grade students. When pre-service elementary teachers complete the program, they are going to be certified to teach basic science, mathematics, the properties of native language, art, music and physics to 1^{st} through 4^{th} grade students. In Turkey, elementary school curriculums were revised and accordingly educational faculty programs were revised in order to make pre-service teachers scientifically literate.

2.2. Materials

In this study, two different questionnaires were administered in order to determine pre-service teachers' epistemological beliefs in terms of two different framework. The following instruments were used in the present

study: Epistemological Beliefs Assessment for Physical Science (EBAPS) and Discipline-Focused Epistemological Beliefs Questionnaire.

2.2.1. Epistemological Beliefs Assessment for Physical Science (EBAPS)

Pre-service teachers' epistemological beliefs of physical science were examined by Epistemological Beliefs Assessment for Physical Science (EBAPS). This instrument was developed by Elby, Frederiksen, Schwartz, and White (The Idea Behind EBAPS, 2002). This instrument was translated into Turkish, adapted and validated by Yıldıran, Demirci, Tüysüz, Bektaş & Geban (2011). Originally, this instrument consisted of three parts. Part I consisted of statements to be rated from strongly agree to strongly disagree depending upon the participants beliefs. Part II consisted of six multiple choice questions related to the context specific scenarios. Part III consisted of seven multiple choice questions related to the exchange of dialogues in context-specific cases amongst students. This instrument has five dimensions: structure of scientific knowledge, nature of knowing and learning, real-life applicability, evolving knowledge and source of ability to learn. Pulmones (2010) scored each item on a scale of 0 (least sophisticated) to 4 (most sophisticated).

2.2.2. Discipline-Focused Epistemological Beliefs Questionnaire (DEBQ)

Pre-service teachers' domain specific epistemological beliefs were examined by Discipline-Focused Epistemological Beliefs Questionnaire. This instrument was developed by Hofer (2000). It was translated into Turkish, adapted and validated by Topçu (2012). This instrument consisted of statements and each item refers to a field or subject matter as the frame of reference. Participants were required to respond each item while considering the particular discipline, i.e. physics, biology or chemistry. This instrument has 27 items on a five-point likert type scale (strongly disagree to strongly agree). The dimensions were *certainty and simplicity of knowledge, source of knowing* and *justification for knowing*.

3. Results

In order to determine the relation between pre-service teachers' epistemological beliefs in terms of Hofer (2001) and Hammer & Elby (2002) views, bivariate correlation analysis was conducted.

Table 1. Pearson correlation coefficient values related to epistemological beliefs views.

	Epistemological beliefs related to Hammer & Elby view				
Epistemological beliefs related to Hofer view	Structure of scientific knowledge	Nature of knowing and learning	Real-life applicability	Evolving knowledge	Source of ability to learn
Certainty and Simplicity- physics	.180	.098	.001	.176	-.171
Source: authority- physics	.231*	.032	-.035	.069	-.059
Justification: personal- physics	-.013	.085	-.019	.043	.061
Certainty and Simplicity- chemistry	.130	.022	-.066	.225*	-.178
Source: authority- chemistry	.216*	.099	-.038	.075	-.055
Justification: personal- chemistry	-.063	-.011	.031	.014	-.032
Certainty and Simplicity- biology	.094	.098	-.093	.230*	-.180
Source: authority- biology	.199*	.075	-.016	.049	-.090
Justification: personal- biology	-.155	-.076	-.145	-.051	.021

*significant at 0.05 level.

According to Table 1, there is a relation between epistemological beliefs in terms of Hofer and Hammer & Elby views in different dimensions. For example, according to Hofer's view in physics dimension, there is a significant correlation between source: authority and structure of scientific knowledge dimension. According to Hofer's view in

chemistry dimension, there is a significant relation between certainty and simplicity and evolving knowledge. Also, according to Hofer's view in chemistry dimension, there is a significant relation between source: authority and structure of scientific knowledge dimension. According to Hofer's view in biology dimension, there is significant relation between certainty and simplicity and evolving knowledge dimension. Also, there is a significant relation between source: authority and structure of scientific knowledge dimension.

Table 2. Elementary pre-service teachers' correlation values related to epistemological beliefs views.

	Epistemological beliefs related to Hammer & Elby view				
Epistemological beliefs related to Hofer view	Structure of scientific knowledge	Nature of knowing and learning	Real-life applicability	Evolving knowledge	Source of ability to learn
Certainty and Simplicity-physics	.239	.168	-.127	.199	-.299*
Source: authority- physics	.068	.021	-.084	.116	-.175
Justification: personal- physics	-.113	.143	-.002	.086	-.104
Certainty and Simplicity-chemistry	.213	.103	-.149	.235	-.277
Source: authority- chemistry	.079	.128	-.071	.109	-.175
Justification: personal- chemistry	-.241	.064	-.054	.094	-.068
Certainty and Simplicity-biology	.162	.188	-.161	.237	-.262
Source: authority- biology	.073	.121	-.046	.092	-.207
Justification: personal- biology	-.210	.073	-.228	-.087	-.141

*significant at 0.05 level.

According to Table 2, in terms of elementary pre-service teachers, there is a significant relation between Hofer's certainty and simplicity dimension in physics and source of ability to learn.

Table 3. Science pre-service teachers' correlation values related to epistemological beliefs views.

	Epistemological beliefs related to Hammer & Elby view				
Epistemological beliefs related to Hofer view	Structure of scientific knowledge	Nature of knowing and learning	Real-life applicability	Evolving knowledge	Source of ability to learn
Certainty and Simplicity-physics	.073	-.033	.161	.139	.027
Source: authority- physics	.405**	.039	-.007	-.001	.130
Justification: personal-physics	.107	.008	-.034	-.010	.229
Certainty and Simplicity-chemistry	.050	-.095	.042	.219	-.114
Source: authority- chemistry	.390**	.050	-.008	.023	.106
Justification: personal-chemistry	.159	-.112	.128	-.085	.121
Certainty and Simplicity-biology	.036	-.020	-.012	.226	-.136
Source: authority- biology	.371**	-.018	.002	-.030	.115
Justification: personal-biology	-.050	-.302*	-.030	.007	.164

*significant at 0.05 level.

**significant at 0.01 level.

According to Table 3, in terms of science pre-service teachers, there is a significant relation between Hofer's source: authority dimension in physics and structure of scientific knowledge. There is also a significant relation between Hofer's source: authority dimension in chemistry and structure of scientific knowledge. Also there is a significant relation between Hofer's source: authority dimension in biology and structure of scientific knowledge.

There is a significant relation between Hofer's justification: personal dimension in biology and nature of knowing and learning.

4. Conclusions

According to the result of the study, it can be concluded that there is a correlation between Hofer's and Hammer & Elby's epistemological belief views. Especially, there is a correlation between source: authority dimension in Hofer's framework and structure of scientific knowledge in Hammer & Elby framework. Also, there is correlation between certainty and simplicity dimension in Hofer's framework and evolving dimension in Hammer & Elby dimension. When the correlation was considered in science and elementary pre-service teachers separately, the results were different. In terms of science pre-service teachers, in addition to the correlation between source: authority in Hofer's framework and structure of knowledge in Hammer & Elby framework; there is a correlation between justification: personal and nature of knowing and learning in Hammer & Elby framework. In terms of elementary pre-service teachers, there is no correlation between source: authority in Hofer's framework and structure of knowledge in Hammer & Elby framework. Thus, according to the result of the study, it could be stated that science and elementary pre-service teachers' epistemological beliefs should be considered separately.

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